Alternate Reality Game in Education: A Literature Review

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Abstract

Using the Alternate Reality Game (ARG) game type to improve non-game products is more and more popular in the 21st century. However, as an important field of ARG implementation, the usage of ARG in education area is still at its early stage. This paper seeks to provide an overview of current research about the implementation of ARG in the educational field, as well as make a general conclusion of how ARG techniques can benefit the education context. The authors undertook a literature review that systematically examined the general development trend of educational ARG implementation from the perspectives of timeline and by field of education. By bringing together previously separate and disparate literature, this paper contributes to providing new understanding of this emergent area of gamification research. In the final section, we discuss our findings and propose some challenges to be faced in the future for gamificatiojn in general and for the AGR game type in particular.

Key words

Alternate Reality Game (ARG), educational ARG, gamification

Introduction

Gamification is a newly emerging area of academic research. The term first appears in 2008, and then shows a widespread adoption after 2012 (Dicheva et al., 2015). As a newly emerging research topic, the development of gamification theories are still occurring. In fields such as business, education, and public service, gamification is being regarded as an effective tool to reinforce participants' motivation, and to improve productivity. However, as the development of gamification is still in its infancy, it is necessary for researchers to have an awareness of the larger picture of the evolution of gamification. This article reviews the Alternate Reality Game (ARG), a particular game type of the gamification developing trend, and its

[1] This paper informed by gamification research conducted by the authors Hu & Zhang in 2015, providing insight into the literature through the preliminary findings of that small study.

implementations in the education field. By showing an overall view of ARG implementation in the educational context, this article offers inspiration for researchers to pay attention to amalgamation of the ARG with educational needs.

Gamification

According to Werbach and Hunter (2012), gamification means using game elements and game design techniques in non-game contexts. This definition includes two parts: game elements and game design techniques, and non-game contexts. Game elements and game design techniques represent the components of building a game-like system, while non-game contexts stands for the objectives that utilizing gamification theories and designs (Werbach & Hunter, 2012). From this definition, the nature of gamification is not just using game or game elements in other fields. It concerns more than the game itself, such as game design, game techniques, and game thinking (Cheong et al., 2014).

Using game elements and even the notion of winning a 'game' in non-game industries is becoming more common. In many areas, for example, business, marketing, military, management, and education, gamification has been shown to have potential to bring benefits (Cheong et al., 2014; Dicheva et al., 2015). For example, airline companies use points and rewards in loyalty programs to keep customers; IT companies use achievement systems to improve their productivity; even the US government has designed a virtual system called *America's Army* to help recruiting soldiers for military purposes. Cheong et al. (2014) have also given examples for gamification implementations in people's daily life as follow:

> (1) *LinkedIn*, which uses progress bars to encourage users to complete their profiles, (2) *EpicWin*, in which users get points for completing items from their to-do lists, and (3) *Fitocracy*, in which users get points for exercising. (p. 234)

The usage of gamification techniques can bring benefits to non-game industries. For example, gamification can make people more engaged in the target activity, and they are able to develop via friendly competitions (Dicheva et al., 2015). Gamification can also create collaboration in social interaction (Jagoda et al., 2015), and even increase students' self-efficiency in educational context (Banfield & Wilkerson, 2014). All these benefits have shown a positive perspective in the development of gamification, thus it is necessary for researchers to study more specifically the adaptation of gamification techniques in the educational context.

Gamification contains all kinds of game types, covering traditional board games to the newest video games. This paper reports on a review of literature about one type of gamification in the educational context, ARG. Preliminary studies (e.g. Whitton, 2009; Sierra & Stedman, 2012) suggest that international students' cross-cultural adaptation to higher education studies was positively supported by the use of ARG.

Alternate Reality Game

Alternate Reality Game (ARG) is a new game format that takes place both online and in the

real world, and combines narrative and puzzles to develop a collaborative community (Whitton, 2008). This game uses the real world as the gaming platform. Players use multimedia tools to get the storyline of the game, and complete the puzzles and quests in the game (Zhou & Fang, 2014, in Chinese). According to McGonigal (2011), the ARG is "a game you play in your real life" (p. 120).

ARG includes four typical characteristics for defining: having an ongoing storyline; making use of many different media types; providing a collaborative environment; and creating an interactive game world to the players (Steward, 2006). Consequently, the nature of ARG can be seen as interactive and collaborative (Connolly et al., 2011).

A typical ARG game structure includes the game design crew, the “Puppet Master”, the game community leader and the learning type player (Zhou & Fang, 2014, in Chinese). The design crew builds the entire game world and storyline, while the “Puppet Master” who plays as the Non-Player Character (NPC) in charge of narrating the storyline to players. The learning type player among the entire player group will follow the clues and storyline, complete the quests and finish the game. On the other side, the game community leader plays a parallel role as the “Puppet Master”, but is not involved in the game play process. Their responsibility is offering technical guidance to players, and reporting the player’s gaming activity outcomes to the design crew. With the coordination of these four groups, a successful ARG structure can be built, the game design can be improved in real time, and effective game play can be made.

Based on the game design elements, there are three integrated components of ARG. The first is the exposition, which stands for the story and events that drive the game, the characters and their motivations, and the world they live in. The second is the interaction, which uses a dynamic dialogue between the players and the game characters. The third is the challenge that provides the game play (Whitton, 2008). Due to these features, one notion of the ARG design is that “this is not a game” (Whitton, 2008), which allows the players to shift between the real world and the fictional realm by themselves.

The attempt of adopting ARG into scenarios other than the game environment in the real world is one practical exploration of gamification. With the help of the nature and features of ARG, when adapting to other areas, it is effective to make those non-game products and services more enjoyable and engaging (Deterding et al., 2011). In addition, the ARG can also design for the development of critical thinking, teamwork capacities, and problem-solving skills (Jagoda et al., 2015). The ARG also has the potential to generate attractiveness and sustainability. Johnston et al. (2012) have stated that the game design elements can influence the attractiveness of playing, which includes “the need of concentration, challenge skill, clear goals and feedback and social interaction” (p. 830). Kim et al. (2008) have also pointed out that “the gamers’ sustained, active and voluntary participation is the most important condition of the ARG experience” (p. 38). According to Johnston et al. (2012) and Kim et al.’s (2008) arguments, there is a clear indication that the ARG has the potential to fit all requirements of being attractive and sustaining to the participants.

All the benefits that the ARG can bring to non-game context demonstrate potential for use in the educational context, which depicts a much more enjoyable scenario for learners. The use of ARGs in education is also something that will eventually engage researchers. As there is a growing interest in "learning through play" (Johnston et al., 2012, p. 829) in the educational field, ARGs' potential in educational contexts has been examined specifically in the review of literature.

Methodology

To construct this literature review, it is necessary to select appropriate methodology to collect data. As this article is mainly a review of previous research literature, the main data comes from records of relevant research projects. By searching keywords on the ProQuest platform, specific documents were selected from a range of education-related databases. The searching keywords included: "gamification", "Alternate Reality Game" and "ARG in education". The document type included book chapters, journal articles, research proposals, reports, and web pages.

The literature has been analysised by classification statistics. Based on the search results, documents were classified into different categories by topics. The main article topic was found to be "ARG in education", and other articles with information such as general introduction of gamification and ARG were classified as supplemental. Articles about "ARG in education" were counted and analyzed. The first step of analysis was to list all the educational ARG projects, then sort those cases via different criteria such as time sequence or located field. Based on the analysis of these literature, the development trend of ARG in educational field could be analyzed, and suggestions for further educational ARG study can be provided. The analyzed research data is presented by using both contextual and visual methods. In addition to descriptions of the literature, charts and table have also been used to make the research findings more understandable.

The majority of the literature about educational ARG research that were chosen have been peer reviewed and written in English, so the dependability and credibility can be ensured by an English-speaking audience. One non-English article was included in this literature review, Zhou and Fang's (2014) ARG Educational Games: a New Type of Educational Game. The purpose of including this article was to provide a possibly different perspective of ARG research in a non-English speaking country that was familiar to the researchers. This article is written in Chinese, and the citations in this article are translated into English. The authors also note that there is an emerging literature internationally in many languages that would be of interest to a more comprehensive study, given the interest and excitement surrounding gamification in educational contexts.

ARG in educational context

Many researchers (e.g. Johnston et al., 2012; Connolly et al., 2011; Whitton, 2008) have studied the utilization of ARGs in the educational context. Researchers have found that drawing on its interactive and collaborative features, the ARG can provide platforms for

collaborative study and peer learning, as well as several pedagogical advantages compared to traditional computer games (Whitton, 2008).

Lee (2006) suggests that there is one advantage for the ARG which can be advanced over other computer games, in that it is the player who acts as themselves rather than playing a fictional character in the game. This advantage is attributed to support a large amount of social interaction and collaboration in the ARG game play, and makes it easier for the player to adopt their gameplay into real-life contexts. More specifically, when looking into the educational context, Moseley (2012, pp. 44-47) has outlined seven pedagogic benefits of ARG:

1) facilitating problem-solving skill at all levels;
2) steady and ongoing progress and tangible rewards;
3) employing narrative devices such as characters, plot and story to stimulate curiosity and engagement;
4) players have the power to influence the outcomes of the game;
5) regular delivery of problems and events to maintaining engagement, allows the game to be modified and provides space between events for students to reflect;
6) potential for a large active community to be built around the game;
7) based on simple, existing technologies, do not require the high-end production values and he same levels of technical expertise or expense to produce as commercial games.

All these benefits found in research studies give reasonable support to adopting the ARG in educational practice. Besides these benefits, Whitton (2008) has found that there is an additional advantage to using the ARG in educational contexts: it can be easily modified to accommodate a different overarching storyline that may be more appropriate for different age groups, locations, or subject disciplines. This feature is adaptable to one of the most important ARG design goals, which is expanding the number of active players in the game. With the broader range of general active players, it is possible to develop advanced and skillful players. Focusing on those advanced players, when delivering more systemic knowledge and superior challenges to them, the outcome of "learning through play" can be more effective (Zhou & Fang, 2014, in Chinese). As the ARG has shown benefits in educational perspective, scholars such as Connolly et al. (2011), and Whitton (2009) began researching the link of the ARG design to different aspects of educational practice. In the next section, a review of ARG in different educational fields will be presented, showing the diversified progress of educational ARG implementation in the last few years.

The resource of gamification can vary from traditional broad games to newest digital games (Stanley & Mawer, 2008), thus it is easy to find actual cases for gamification implementation. Despite the gamified elements on social network like *LinkedIn* and *EpicWin* (Cheong et al. 2014), there are also completed game programs such as the *U.S. Army*, which is a recruitment tool for the United States army (Flores, 2015). All these websites and programs are showing the progress of gamification development, and provide reasonable references to further studies.

However, when looking into specific type of gamification resource, such as the ARG, the cases are more restricted. Studying the feature of integrating the real world and fictional world together, and telling a story that can be affected by participants (Steward, 2006), the ARG shows a potential in areas which need to develop the skill of 'absorbing' and 'understanding of information', like the education field. Thus when examining the development of the ARG, it is necessary and possible to look in to the ARG's practical usage in the educational context. In the following sections, the ARG implementation in different educational areas will be discussed, in order to offer arguments and insights for further discussion.

Student induction and orientation

The first challenge for most students, especially overseas students new to the university campus setting, is the problem of adjusting to the new environment. Therefore, student induction and orientation problems are familiar to those responsible for settling newly arrived students into university life. The adoption of the ARG in students' induction and orientation offers new potential for researchers and university program managers alike to find alternative, effective solutions for students. Whitton (2009), Piatt (2009), and Sierra and Stedman (2012) have presented positive findings when researching the use of the ARG in the student induction and orientation aspect.

Whitton led a research project based in the United Kingdom called the Alternate Reality Games for Orientation, Socialization, and Induction (ARGOSI) project at Manchester Metropolitan University in 2008 (Zhou & Fang, 2014, in Chinese). The ARGOSI's main aim was to provide a novel and engaging alternative to traditional student induction (Whitton, 2009). By offering an ARG called *Viola Quest*, the project aimed to improve students' induction experience. The purpose of this ARG was to help students to develop basic library study and information skills, create social networks, and have an enjoyable induction experience during the orientation period. According to Whitton (2009), the entire project achieved its aim of developing and piloting an ARG for student induction. For some students, the game provided an effective and appropriate chance for them to meet library learning outcomes and offered an enjoyable induction experience. However, Whitton found that the purpose of helping students to create and support social networks, or the purpose of helping them to navigate the campus and city had little supporting evidence, and needed further research.

Piatt (2009) presents another ARG research project at the University of Brighton in the academic year 2006/2007. This research project aimed to help the first year students at the University of Brighton get better involved in the higher education environment. The purpose of the project was to help new students make better use of online and offline resources, to provide information to students who missed induction content, and to enhance students' social activity in their school life (Piatt, 2009). The research project used an ARG called *Who is Herring Hale?* This game was mostly delivered via e-mail and online blogs to students who participated in the project. The game lasted for nine weeks and attracted nearly 300 students. Through the entire process of the game, the author pointed out that this ARG

has helped students' engagement, through aspects such as offering tasks that require students to work together and help each other. The feedback from participants confirms the helpfulness from the game, as they have mentioned that playing the game helps to figure out missing information, offer new perspective, and provide fun as well (Piatt, 2009). However, the ARG also showed some limitations such as material and facility accessibility, teamwork task design, and web system usability. The author has also mentioned that these limitations will need further investigation, and plans to repeat this ARG project in another academic year in order to deepen the research (Piatt, 2009).

Sierra and Stedman (2012) present another ARG research at the University of South Florida. Their research contains two progressive parts. At the first part, they develop a simple role-playing game called *C's the Day*. This is a game that running as a part of the Conference on College Composition and Communication (Sierra & Stedman, 2012). According to the authors, this game is "a collaboratively developed game designed to engage people, particularly newcomers, at the Conference on College Composition and Communication" (Sierra & Stedman, 2012, p. 3). The game is inspired by the concept of large scale ARG, and tries to encourage participants to explore more at the conference, in order to expand and enhance their conference experiences. The creators of the game believe that this project can provide better guidance and social interaction to conference attenders, and even has further positive influence in the research field of games and learning (Sierra & Stedman, 2012). According to the game winner's feedback, this game is actually provided a better environment of social interaction, as well as motivating positive emotional experience. Based on the experience of running *C's the Day*, the scholars conducted a further research project at the University of South Florida in the 2011 orientation period. This time, they create a game called *FYC's the Day*, which is developed from the design of *C's the Day*, and was used to provide better orientation experiences to their new and returning First-Year Composition teachers (Sierra & Stedman, 2012). The game system shows the important aspect of flexibility in being able to adapt the game design and focus from the highly successful *C's the Day*, with more content, like tasks and rewards, and more flexibility for attenders to arrange their own schedule. This version of the game ended with a result that was not as ideal as anticipation, but it still provided useful data for researchers in their developing understanding of the use of ARGs and for game designers for future improvements. From this project, the researchers summarize that this kind of gamification implementation can make participants more engaged in orientation events, but it is not easy to create and improve the game design (Sierra & Stedman, 2012).

Language and cultural education

The language and cultural education is another area that draws the ARG researchers' attention. An engaged and immersed situation can motivate students' language acquisition outcome (Ranalli, 2008), and creating an engaging environment is the task that the ARG can provide (Deterding et al., 2011). As language is a privileged medium to foster a 'culture system' (Hall, 1997), the benefits from ARG also show the potential in the cultural learning aspect. Therefore scholars such as Connolly et al. (2011) and Dondlinger and Wilson (2012) seek ways to integrate the ARG with language and cultural education.

Connolly et al.'s (2011) research is part of The European Union's Comenius project. This research focuses on secondary school students in European countries using an ARG to motivate them to learn a modern foreign language (Connolly et al., 2011). An ARG named *Tower of Babel* was developed to improve those students' foreign language and culture study. In the game scenario, in order to save the world from a future cultural genocide disaster, students need to contribute information to a mysterious organization in the game. The puzzles and challenges in *Tower of Babel* are presented in several different European languages, and it contains an array of European countries' historical and cultural knowledge. Through this ARG, the researchers have received positive feedback from both language teachers and students, and the ARG project has been considered as largely successful (Connolly et al., 2011).

Besides language education, in the cultural learning area, the ARG also brings other benefits. Dondlinger and Wilson (2012) conducted a research project to examine the result of integrated, contextualized, and authentic learning experience design for southwestern United States college students. In this project, a course system called the *Global Village Playground (GVP)* was designed to help students get better learning outcome from the general learning curriculum. According to the authors, the *GVP* is "an interdisciplinary learning community in which students worked as a team tasked with developing an alternate reality game that makes an impact on the United Nations Millennium Development Goals" (Dondlinger & Wilson, 2012, p. 154). The *GVP* aims to enhance students' perspectives on social relationship, responsibility in a culturally diversified world, develop science and technology literacy, problem solving skills, etc. The *GVP* course lasts for sixteen weeks, and delivers to students via four major subjects: speech, literature, humanities and composition (Dondlinger & Wilson, 2012). The results from of this research are impressive. Participants report that through the study of *GVP* courses, multiple skills have been fostered, such as large-scale thinking, social relationship and connection, and values of personal responsibility and ethical behavior (Dondlinger & Wilson, 2012). Besides the achievements the project has made, the authors also point to the limitation that the research of ARG enhanced cultural and social education needs to focus on students' individual perspective in further studies.

Physical education

One important feature of the ARG is integrating the game system with the real world, because the ARG bases its design on real world activities (McGonigal, 2011). This feature offers another perspective for researchers to discover new possibility to combine the ARG with physical activity education. In this field, Johnston et al. (2012) have presented a research project about using ARG to deal with obesity problems.

This research project aims to use ARG to enhance college students' physical activity. The authors hypothesize that the ARG participants' physical activity level will be higher than non-players' level and higher physical activity level can reduce a weight gain trend (Johnston et al., 2012). The researchers have designed an ARG named *The Skeleton Chase*, which tells a story about rescuing a kidnapped professor and shutting down an illegal experiment. The game is conducted in the health course at Indiana University, and is delivered via multi-media

pathways. The researcher specifically points out that this game is not designed as a physical activity game. It is designed to improve levels of physical activity by influencing behavioral change and tangential learning, with physical activity as a backdrop to gameplay (Johnston et al., 2012, p. 831). The research lasts for 9 weeks. At the end of the project, the researchers concluded that their hypothesis that ARG participants' physical activity level will be higher than non-players' level has been confirmed by the research data. However, another hypothesis of reducing the weight gain trend by higher physical activity level is not supported by the result. The researchers point out that their research focuses on the right population, and they have designed appropriate research methodology and techniques such as the ActiPed monitor and the three-person student teams (Johnston et al., 2012). At the same time, the researchers also admit that the project has limitations such as limited sample group and unanticipated concerns about nonplaying problems from participants. In general, this project achieves the eexpected goals, and offers findings for further health intervention researches.

Emergency response training

Emergencies are unexpected in people's daily life, and for most occasions, emergencies can be dangerous and vital. People need to understand how to deal with emergencies, but the knowledge and skills to response emergency are not naturally for people (Zhou et al., 2014). Researchers have already studied emergency response training with card games and computer simulation games (e.g. Hayashi et al., 2008; Rüppel & Schatz, 2011). Now with the help of the ARG's feature of play in the real world (McGonigal, 2011), new perspective for study of emergency response problems has emerged.

Fischer et al. (2012) run a project called *AtomicOrchid* to study the coordination and collaboration in disaster response scenarios. The game is about solving a radioactive disaster with teamwork and coordination in extreme situations (Zhou et al., 2014). The game uses electronic devices as basic tools, and combines the real-time world with fictional storyline together. The project aims to study how computational agents can help or hinder human emergency responses. The researchers outline the research plan, and claims that they will provide further results when the project is finished (Fischer et al., 2012).

Urano et al. (2012) present another ARG system for participants to experience simulated disaster events (Zhou et al., 2014). It is called *Disaster Experience Game (DEG)*, by detecting players' location, the game system matches certain disaster events to players, and offers an experience of dealing with emergency situation to players. According to the player's feedback, the game can actually enhance their skills of response to emergencies, as well as offer fun (Zhou et al., 2014). Likewise, players reported the appeal of being able to play the game in a larger participant group (Urano et al., 2012), and it is the further study direction for the project.

Science education

Science education often requires experiments and practical learning through observation and operation. From this perspective, the ARG's feature of offering the potential for the

development of critical thinking, teamwork capacities, and problem-solving skills (Jagoda et al., 2015) provides possible applicability for ARGs in science education.

Bellocchi (2012) presents his experience of integrating ARG into science education. In his research he designs an ARG called the *STEM ARG*, which aims to engage pre-service teachers in science, technology, engineering and mathematics disciplines (Bellocchi, 2012). The game contains two phases. The first phase is a introductive module where the players can learn basic informations about the game, like the story background, how play it, and what they need to do next. The second phase is an interactive module, where players solve quests and challenges to take control of the storyline. Participant need to use information and communication technology tools, web 2.0 systems and other digital literacy to complete the challenges and quests (Bellocchi, 2012). During this process, participants can reform and reinforce their recognition of the STEM curriculum and issues. With the help of this game system, the author finds a novel and engaged method to improve the STEM teachers' performance in teaching. Simultaneously, this research also offers insights for further study of using ARG to improve high school and university science education outcomes (Bellocchi, 2012).

Sexual education

As an important part of the adolescent and young adult education, sexual education can also benefit from the use of ARGs. New media interventions have been introduced into sexual health education (e.g. Bailey et al. 2012; Gilliam et al. 2012). In the area of using ARG to improve sexual education, Bouris et al. (2016) conduct a case study research at the University of Chicago to explore the prospect. In this case study research, the researchers use an ARG called *The Source* to examine sexual and reproductive health education problems (Bouris et al., 2016). The game is a five-week puzzle solving game where players can learn science and social knowledges by overcoming challenges. The researchers linked the game content to the purpose of study, sexual education improvement, and organized focus groups to collect research data. According to these data, the researchers found that "ARGs provide an alternative approach to sexuality education that provides young people and educators with an interactive platform through which to explore complex topics" (Bouris et al., 2016, p. 363). However, there are still problems that the researchers warn need to be considered, such as balancing the realism and fictional world, paying attention to how to deliver sensitive information, and selecting the appropriate target groups to receive sexual education using the ARG gamification (Bouris et al., 2016).

Finding and Discussion

From the review of literature, we found that there is a clear trend towards using ARG implementation in a variety of educational contexts. From the perspective of the timeline of emergent research based literature, it can be seen that this is a relatively recent field of research study in the educational context (*see Table 1*).

Table 1 - Educational ARG Research Example Coverage

Year	**Research field**	**Researcher**	**ARG program**
2009	Student induction and orientation	Whitton	Viola Quest
		Piatt	Who is Herring Hale?
2011	Language and cultural education	Connolly et al.	Tower of Babel
2012	Student induction and orientation	Sierra & Stedman	C's the Day & FYC's the Day
	Language and cultural education	Dondlinger & Wilson	Global Village Playground (GVP)
	Emergency response training	Fischer et al.	AtomicOrchid
		Urano et al.	Disaster Experience Game
	Physical education	Johnston et al.	The Skeleton Chase
	Science education	Bellocchi	STEM ARG
2016	Sexual education	Bouris et al.	The Source

The earliest two articles for educational ARG research are Whitton's ARGOSI project and Piatt's design of *Who is Herring Hale*? Both articles are published in 2009, but Piatt's research is first, being conducted in 2006, while Whitton's project is in 2008. After 2010, the number of educational ARG research article shows a large increase, especially in year 2012. Connolly et al. present the study of *Tower of Babel* in 2011, and in the next year, there are six research articles published that relate to educational ARG study (Sierra & Stedman, 2012; Dondlinger & Wilson, 2012; Johnston et al., 2012; Fischer et al., 2012; Urano et al., 2012; Bellocchi, 2012). The newest research about educational ARG is Bouris et al.'s sexual education study with *The Source* in 2016.

By undertaking an anlysis of the educational ARG publication numbers by year, we can also see the development of its utilization *(see Chart 1)*.

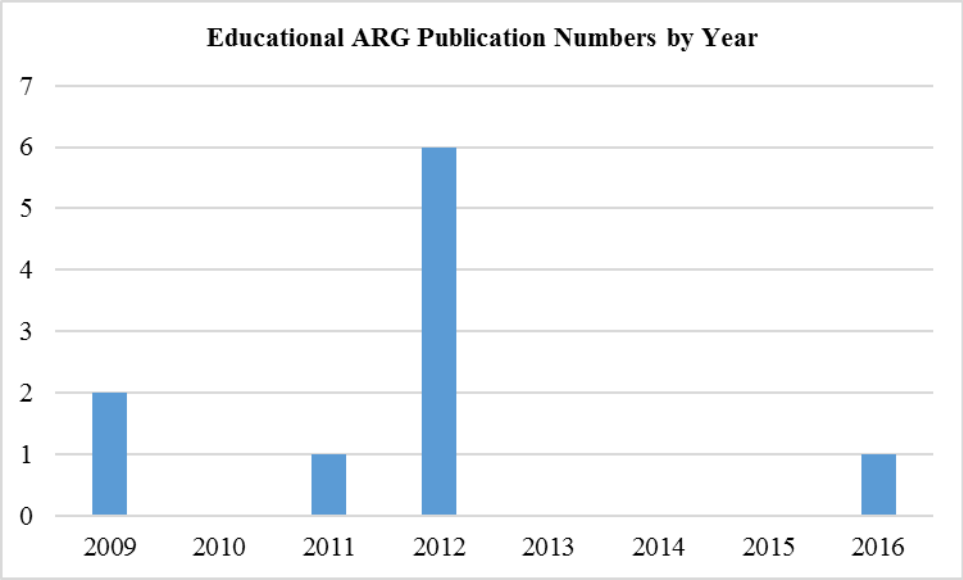

Chart 1: Educational ARG Publication Numbers by Year

At the early stage of educational ARG study, the focus of ARG implementation was mainly located in the university-level students' induction and orientation field. As the earliest two project, both Piatt (2009) and Whitton (2009) put their attention to improving students' induction experience using the ARG design. After 2010, the study of educational ARG has extended to a larger number of fields, especially in the year of 2012. It now spans social science subjects such as language and cultural education (Connolly et al., 2011; Dondlinger & Wilson, 2012) to health education-related emergency response education (Fischer et al., 2012; Urano et al., 2012), to science subjects and physical education (Johnston et al., 2012; Bellocchi, 2012). For the newest educational ARG research, it has extended its applicability to sexual education (Bouris et al., 2016).

Analysing this small but rapidly growing field of literature, student induction and orientation has reported the largest number of studies in ARG research. There are three articles that report their findings about this topic. The fields of language and cultural education and emergency response training are ranked in the second place, with each field comprising two research-based articles. The other education contexts comprising physical education, science education, and sexual education all report one research article for each (*see Chart 2*).

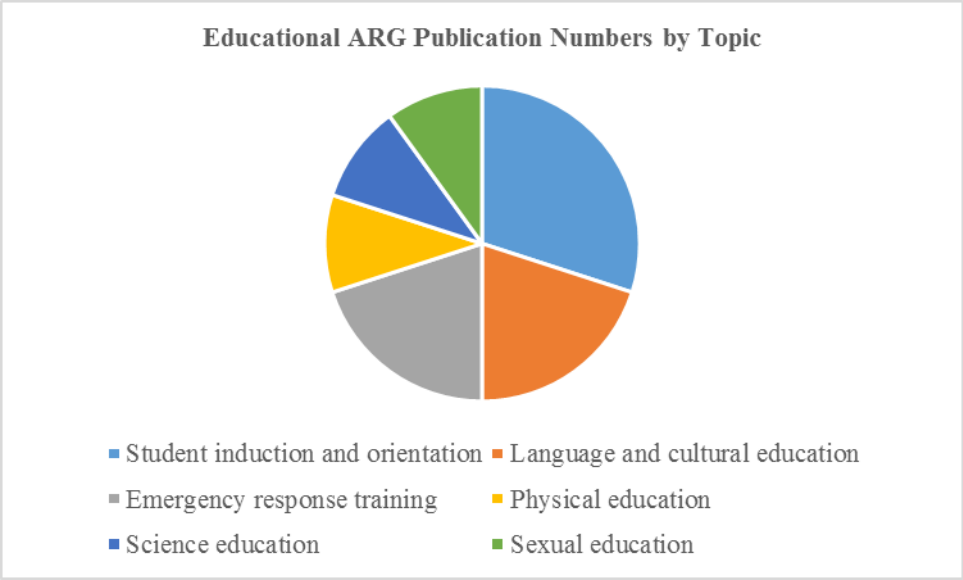

Chart 2: Educational ARG Publication Numbers by Topic

From this development trend, it can also be seen that the research area of educational ARG implementation is expanding, and more educational areas have been influenced by the ARG intervention (*see Chart 3*). The most common education field that connecting to ARG implementation study is the student induction and orientation field, while other fields are increasingly drawing attention from educational ARG researchers.

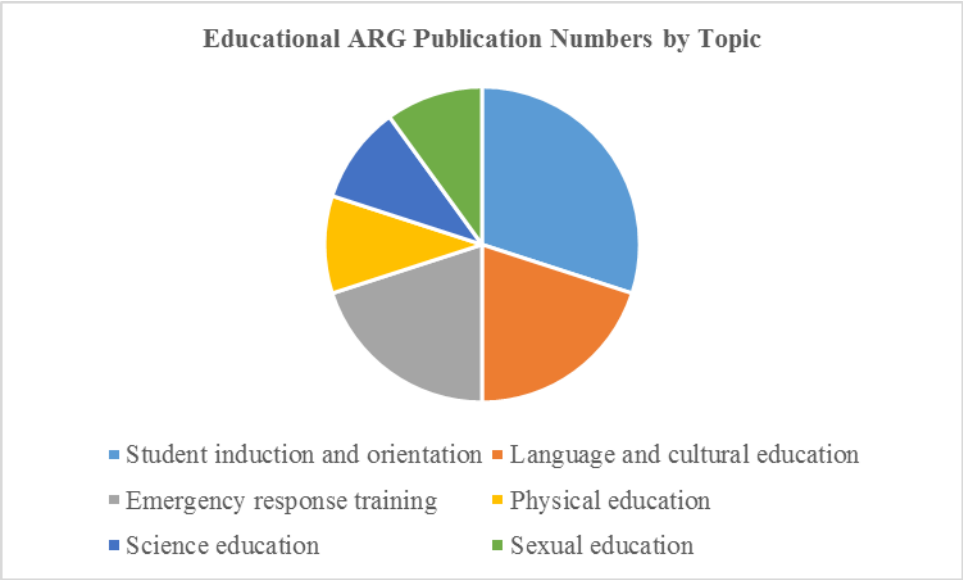

Chart 3: Educational ARG Research Field Expanding

Conclusion

In this article, a review of literature has been made to examine the implementation of ARG in the education context. ARG is a newly emergent game type that takes place both online and in

the real world, and combines narrative and puzzles to develop a collaborative community for players (Whitton, 2008). According to previous studies, the game type of ARG can bring benefits to educational aims and purposes such as providing platforms for collaborative study and peer learning, and offering practical learning via social interaction (Lee, 2006; Whitton 2008).

The benefits of using ARG techniques in educational contexts can be concluded from the literature. Across the abovementioned research studies, the most reported positive finding are the ARG features of integrating the real world and fictional context together, and providing engaged learning environment that is helpful for educational purposes (Steward, 2006). These benefits are especially clear in the research of student induction and language education. Apart from these common benefits, the ARG also provides advantages such as helping participants reform social recognition via game play (Dondlinger & Wilson, 2012), and offering fun to participants while learning things (Urano et al., 2012). All these benefits reflect that the ARG has positive influence in educational purposes, and as the implementation area is still expanding, the benefits will be more explicit. Important too are the challenges posed in using gamification in the educational context where there has sometimes been difficulty in bringing the aims of the game design into alignment with the aims of the education context. The feature of ARG seems to be that it has the capacity to evolve in the real world context in response to the player needs and feedback and such potential may see significant increase in the use of ARGs in educational contexts, particularly amongst adult learners in universities and colleges.

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